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10/531,314	09/10/2007	John McNicol	102831/00043	6434

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EXAMINER	
LI, SHI K	

ART UNIT	PAPER NUMBER
2613	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

karen.forgie@blakes.com

Office Action Summary	Application No.	Applicant(s)	
	10/531,314	MCNICOL ET AL.	
	Examiner	Art Unit	
	Shi K. Li	2613	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *2 March 2011*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9, 11, 14-20, 22-27, 29-35, 37-42 and 44-51* is/are pending in the application.

4a) Of the above claim(s) *5,20 and 35* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,6-9,11,14-19,22-27,29-34,37-42 and 44-51* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☐ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____

4)☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5)☐ Notice of Informal Patent Application

6)☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1-4, 6-9, 11, 14-19, 22-27, 29-34, 37-42 and 44-51 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 1 recites the limitation "parallel orthogonal signal components". However, instant specification does not teach parallel orthogonal signal components. Therefore, it fails to describe the limitation in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claims 14 and 34 recite similar limitation.

Claim 8 recites the limitations "amplitude and phase signal components" and "amplitude and frequency signal components". Instant specification does not describe the limitation in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claims 22 and 37 recite similar limitations.

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-4, 6-9, 11, 14-19, 22-27, 29-34, 37-42 and 44-51 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites the limitation "two parallel orthogonal signal components" in lines 7-8 of the claim. The orthogonal means the two components are 90 degrees out of phase. Parallel usually means in phase. Therefore, it is unclear whether the two signal components are in phase or 90 degrees out of phase.

Claims 14 and 34 recite similar limitation.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1-3, 6-9, 11, 14, 19, 22-23, 29, 34, 37-38, 44 and 50-51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Price et al. (U.S. Patent 6,522,439 B2) in view of Jeckeln et al. (U.S. Patent 6,072,364).

Regarding claims 1, 14 and 34, Price et al. teaches in FIG. 9 a system comprising an electrical input ΔE, a distorter 32 for generating a pre-distorted signal comprising an I-component and a Q-component, and a modulator 46 for converting the electrical signal to optical signal. Price et al. teaches in col. 3, lines 45-50 that the system compensates dispersion. Price et al. teaches in col. 14, claim 21 that the modulator include at least one of an intensity modulator and a phase modulator. That is Price et al. teaches that the modulator is an intensity modulator, a

phase modulator or an intensity and phase modulator. Price et al. teaches in col. 7, lines 34-44 that the amount of dispersion is determined and used in a compensation function in the distorter 32. The difference between Price et al. and the claimed invention is that Price et al. does not teach a digital distorter. However, digital distorter is well known in the art. For example, Jeckeln et al. teaches in FIG. 1 a digital predistorter. One of ordinary skill in the art would have been motivated to combine the teaching of Jeckeln et al. with the system of Price et al. because digital signal processing technique is efficient and can be adjusted easily by programming. Thus it would have been obvious to one of ordinary skill in the art at the time the invention was made to use digital predistorter, as taught by Jeckeln et al., in the system of Price et al. because digital signal processing technique is efficient and can be adjusted easily by programming.

Regarding claims 2-3, Price et al. teaches in col. 7, lines 34-44 that the amount of dispersion is generally well documented. It is understood that the amount of dispersion must be measured before it is documented.

Regarding claims 6-7, Jeckeln et al. teaches in FIG. 1 predistorter 2 for calculating digital sample values and D/A converter 5 for converting the sample values into analog level.

Regarding claims 8, 22 and 37, Price et al. teaches in FIG. 9 in-phase (I) and quadrature (Q) signal components.

Regarding claims 9 and 11, Jeckeln et al. teaches in col. 6, lines 59-67 mapping signal to M possible symbols, and look-up tables 3 and 4.

Regarding claim 19, Jeckeln et al. teaches in FIG. 1 digital filter (tables 3 and 4) and D/A converter 5.

Regarding claims 23 and 38, Jeckeln et al. teaches in FIG. 1 digital filter (tables 3 and 4).

Regarding claim 29 and 44, Price et al. teaches in col. 14, claim 21 that the modulator include at least one of an intensity modulator and a phase modulator.

Regarding claims 50-51, Jeckeln et al. teaches in col. 6, lines 59-67 mapping signal to M possible symbols, and look-up tables 3 and 4.

7. Claims 4, 15-16 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Price et al. and Jeckeln et al. as applied to claims 1-3, 6-9, 11, 14, 19, 22-23, 29, 34, 37-38, 44 and 50-51 above, and further in view of Sinha et al. (U.S. Patent 7,587,143 B2).

Price et al. and Jeckeln et al. have been discussed above in regard to claims 1-3, 6-9, 11, 14, 19, 22-23, 29, 34, 37-38, 44 and 50-51. The difference between Price et al. and Jeckeln et al. and the claimed invention is that Price et al. and Jeckeln et al. do not teach a function indicative of a difference between the sampled optical signal and a predetermined reference. Sinha et al. teaches in FIG. 1 a pre-compensation system. Sinha et al. teaches in col. 3, lines 30-35 to use a training procedure to determine channel phase distortion and use the results to set pre-emphasis coefficients. One of ordinary skill in the art would have been motivated to combine the teaching of Sinha et al. with the modified system of Price et al. and Jeckeln et al. because the training procedure gives accurate results taking into account all nonlinear effects. Thus it would have been obvious to one of ordinary skill in the art at the time the invention was made to derive the performance parameter by comparing the received signal to the sent predetermined sequence, as taught by Sinha et al., in the modified system of Price et al. and Jeckeln et al. because the training procedure gives accurate results taking into account all nonlinear effects.

8. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Price et al., Jeckeln et al. and Sinha et al. as applied to claims 4, 15-16 and 18 above, and further in view of Bergano (U.S. Patent 6,310,709 B1).

Price et al., Jeckeln et al. and Sinha et al. have been discussed above in regard to claims 4, 15-16 and 18. The difference between Price et al., Jeckeln et al. and Sinha et al. and the claimed invention is that Price et al., Jeckeln et al. and Sinha et al. do not teach measuring bit-error rate. Bergano teaches in FIG. 7 an optical transmission system wherein monitor 550 at the receiver side provides feedback to the modulation process. Bergano teaches in col. 6, lines 15-17 to monitor bit error rate and provide feedback to adaptively adjust the modulation process. One of ordinary skill in the art would have been motivated to combine the teaching of Bergano with the modified system of Price et al., Jeckeln et al. and Sinha et al. because the approach of Bergano optimizes the system performance. Thus it would have been obvious to one of ordinary skill in the art at the time the invention was made to measure bit error rate as a performance parameter, as taught by Bergano, in the modified system of Price et al., Jeckeln et al. and Sinha et al. because the approach of Bergano optimizes the system performance.

9. Claims 24-25, 39-40 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Price et al. and Jeckeln et al. as applied to claims 1-3, 6-9, 11, 14, 19, 22-23, 29, 34, 37-38, 44 and 50-51 above, and further in view of Griffin (U.S. Patent 7,546,041 B2) and Leight (U.S. Patent 6,404,535 B1).

Price et al. and Jeckeln et al. have been discussed above in regard to claims 1-3, 6-9, 11, 14, 19, 22-23, 29, 34, 37-38, 44 and 50-51. The difference between Price et al. and Jeckeln et al. and the claimed invention is that Price et al. and Jeckeln et al. do not teach imposing a delay.

However, it is well known in the art that I and Q signal components must be synchronized to optimize performance. Griffin teaches in FIG. 1 a modulator with I and Q modulating components. Griffin teaches a delay element 10 for imposing a delay. Of course, such delay can be implemented in the electrical domain. For example, Leight teaches in FIG. 1 delay element 28. Furthermore, Jeckeln et al. teaches digital signal process. One of ordinary skill in the art would have been motivated to combine the teaching of Griffin and Leight with the modified system of Price et al. and Jeckeln et al. because alignment of signals optimizes performance. Thus it would have been obvious to one of ordinary skill in the art at the time the invention was made to include a digital delay, as taught by Griffin, Leight and Jeckeln et al., in the modified system of Price et al. and Jeckeln et al. because alignment of signals optimizes performance.

10. Claims 26-27 and 41-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Price et al. and Jeckeln et al. as applied to claims 1-3, 6-9, 11, 14, 19, 22-23, 29, 34, 37-38, 44 and 50-51 above, and further in view of Kahn et al. (U.S. Patent 6,424,444 B1).

Price et al. and Jeckeln et al. have been discussed above in regard to claims 1-3, 6-9, 11, 14, 19, 22-23, 29, 34, 37-38, 44 and 50-51. The difference between Price et al. and Jeckeln et al. and the claimed invention is that Price et al. and Jeckeln et al. do not teach a serial-to-parallel converter. Kahn et al. teaches in FIG. 2 an optical transmitter with serial-to-parallel converter 22, encoder 24, signal generator driver 32 and optical modulator 30. Kahn et al. teaches in FIG. 6c two modulating signal components and intensity and phase modulators. One of ordinary skill in the art would have been motivated to combine the teaching of Kahn et al. with the modified system of Price et al. and Jeckeln et al. because duobinary multilevel optical transmission reduces pulse spreading caused by chromatic dispersion. Thus it would have been obvious to

one of ordinary skill in the art at the time the invention was made to use duobinary multilevel optical transmission via serial-to-parallel converter, as taught by Kahn et al., in the modified system of Price et al. and Jeckeln et al. because duobinary multilevel optical transmission reduces pulse spreading caused by chromatic dispersion.

Regarding claims 27 and 42, it is obvious to divide a number into two parts and store them in two memory block. The Examiner notes that any number can be expressed as a sum of two numbers.

11. Claims 30-33 and 45-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Price et al. and Jeckeln et al. as applied to claims 1-3, 6-9, 11, 14, 19, 22-23, 29, 34, 37-38, 44 and 50-51 above, and further in view of Pidgeon (U.S. Patent 5,850,305).

Price et al. and Jeckeln et al. have been discussed above in regard to claims 1-3, 6-9, 11, 14, 19, 22-23, 29, 34, 37-38, 44 and 50-51. The difference between Price et al. and Jeckeln et al. and the claimed invention is that Price et al. and Jeckeln et al. do not teach compensate for nonlinearity of the modulator. First, Jeckeln et al. teaches that distorter can be used for compensating nonlinearity caused by nonlinear components. Furthermore, Pidgeon teaches in col. 1, lines 35-40 to use pre-distortion for compensating distortions produced by optical modulators. One of ordinary skill in the art would have been motivated to combine the teaching of Pidgeon with the modified system of Price et al. and Jeckeln et al. because the pre-distorter cancels the distortions produced by the modulator, resulting in a linear optical output. Thus it would have been obvious to one of ordinary skill in the art at the time the invention was made to compensate for nonlinearity of the modulator, as taught by Pidgeon, in the modified system of

Price et al. and Jeckeln et al. because the pre-distorter cancels the distortions produced by the modulator, resulting in a linear optical output.

Regarding claims 31-33 and 46-48, Jeckeln et al. teaches in FIG. 1 digital filter and look-up tables. Furthermore, whether to separately compensate for dispersion and nonlinearity of the modulator or combine the compensation together is obvious variation of each other.

Response to Arguments

12. Applicant's arguments filed 2 March 2011 have been fully considered but they are not persuasive.

The Applicant argues that paragraph 64 of the specification teaches amplitude and phase modulation and paragraph 65 teaches frequency and phase modulation. However, instant specification fails to teach how to derive amplitude and phase components that are orthogonal to each other. To the understanding of the Examiner, amplitude and phase are not orthogonal components. Furthermore, they are not parallel components neither. Similarly, instant specification fails to teach how to derive amplitude and frequency components that are orthogonal to each other. To the understanding of the Examiner, amplitude and frequency are not orthogonal components. Furthermore, they are not parallel components neither.

The Applicant argues "US. Patent 6,072,364 (Jeckeln et al.) does not appear to provide the missing teaching. In particular, Jeckeln et al. teaches techniques for adaptive digital predistortion for power amplifiers with real time modeling of memoryless complex gains. Thus Jeckeln et al. provides a digital predistorter for compensating amplifier non-linearity. [see col 1, lines 9-34; cot 5, lines 13-33] Jeckeln et al. does not teach or fairly suggest that a similar arrangement could be used to compensate dispersion in an optical communications system. In

fact, it appears that Jeckeln et al. teaches directly away from any such modification, by teaching that the digital predistorter compensates the memoryless complex gain of the amplifier. [see col 5, lines 29-43]". The Examiner disagrees. It is common sense that familiar items may have obvious uses beyond their primary purposes, and a person of ordinary skill often will be able to fit the teachings of multiple patents together like piece of a puzzle. See KSR International Co. v. Teleflex Inc., 127 S. Ct. 1727, 82 USPQ2d 1385 (U.S. 2007).

The Applicant argues "On the other hand, the person of ordinary skill in the art will recognize that optical dispersion is not memoryless, because the analog value (phase and/or amplitude) of the optical signal at any given location is dependent on the analog value of the signal both preceeding and following that location." It may be true that optical dispersion is not memoryless. However, modeling optical dispersion as memoryless may be good enough for engineering purpose. Jeckeln et al. teaches in col. 5, line 27-32 that modeling is an approximation and it is a compromise between accuracy and complexity. Furthermore, the claim language fails to specify the details of the mathematics to differentiate the claim from an approximation as taught by Jeckeln et al.

Conclusion

13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after

the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shi K. Li whose telephone number is 571 272-3031. The examiner can normally be reached on Monday-Friday (6:30 a.m. - 4:00 p.m.).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Vanderpuye can be reached on 571 272-3078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

skl
20 April 2011

/Shi K. Li/
Primary Examiner, Art Unit 2613